

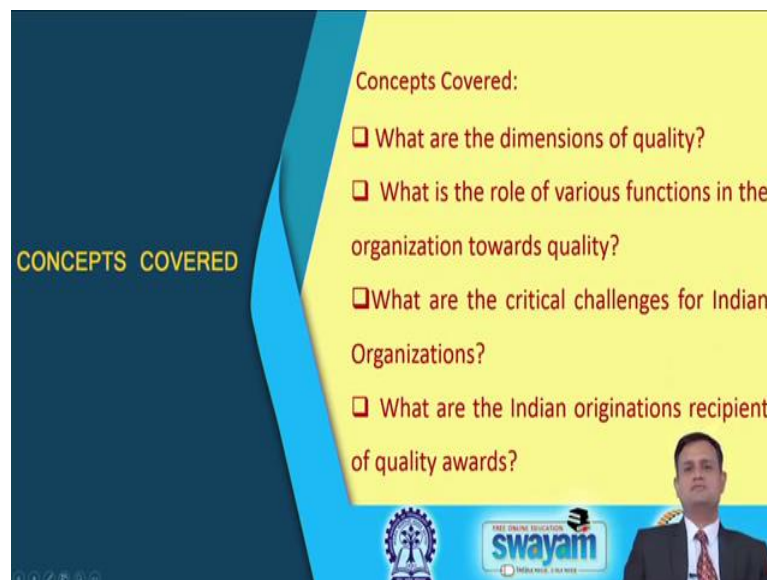
Six Sigma
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Lecture – 02
Quality Concept and Definitions

Hello friends. I welcome you to the second lecture of Six Sigma. I am Doctor Jitesh Thakkar from Department of Industrial and Systems Engineering, Indian Institute of Technology, Kharagpur. This lecture basically will help you to appreciate the various Quality Concepts and Definitions.

You need to see quality as a multi perspective dimension and appreciate that quality cannot be confined to only one or two dimensions. When we say quality is a pursuit for perfection this perfection can be realized in different ways, and hence quality is a multi attribute dimension which needs to be assessed, evaluated and pursued with a proper methodology. So, let us see that as a part of this lecture what we would like to discuss.

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The first important question is what are the dimensions of quality? Does the word quality good enough or should I evaluate the quality with respect to different dimensions? What is the role of various functions in the organizations towards quality? Please remember you cannot realize the quality just by having quality control department. This department just ensures that your processes are within control and you are meeting the quality

standard as expected by your customer. But they cannot really help you to ensure the quality at different stages in the organization.


Question 3, what are the critical challenges for Indian organizations? What is the way forward, if they want to improve upon their quality journey and ensure better and better achievements to meet the global standard where really they need to focus and work on. And finally, we would like to have pride in seeing that there are many Indian organizations they have received highly prestigious quality awards and now we being an India is absolutely ready for two things. Number one, zero defect zero effect. In fact, I have also launched an issue as a guest editor on zero defect zero effect for international journal of quality and reliability management you can see the announcement and try to submit the papers.

The second important aspect is Make in India. So, we are today ready with the excellence realized by many manufacturing and service organizations and ready to take up the challenges for launching our products across the world.

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Why Quality?

- Quality: The obsession of the contemporary world
- Quality: The entry ticket for doing business
- Quality : The order qualifying criteria
- Quality: The truth, beauty and God



So, now let us see why quality. This would just be a small recap what I told in lecture 1 and in nutshell qualities should be seen as an obsession. I want to have this quality because I want to be the best in the world. There could be many icons around us who are living with this passion Sachin Tendulkar, Amitabh Bachchan and many other through

their long experience pursuit for quality proved that it is basically a passion for perfection.

If you see the second point then it is an entry ticket for doing business this is something interesting. You cannot just do the business without ensuring bare minimum quality standards whether it is in terms of rejects, whether it is in terms of product features, whether it is in terms of customer satisfaction and expectation; you simply cannot enter into the market without having the knowledge of your quality expectations from the customer. In view of this, quality has become a qualifying criteria. We will see the advancement of various evolution of history that how the concept of quality has evolved over a period of time and now in 2018 we cannot simply say that my product availability, my product quality, my after sale services are adequate enough to satisfy the customer. The organizations have surpassed all these traditional quality standards and now they are setting new and new benchmarks to achieve.

Finally, in the most simplest word I would say quality is the truth, beauty and god. So, when you say that I want to assure the quality you should not expect anything other than the truth. It means I have my processes is documented and I must stick to those documented standards in order to see that I meet the expected benchmarks of my organization. Beauty, you can just see the picture of Monalisa and this image in fact is utilized extensively for various image processing, software packages as a benchmark image because the features, beauty and various other dimensions captured are just excellent and we believe in god. So, if you believe in god we must have same faith, same kind of devotion for achieving the quality.

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So, what are the advantages of superior quality? Fine, you are doing a business not a charity and you would always feel motivated if you see what are the various advantages of quality.

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There could be many, just to summarize few we want superior benchmark performance and competitive advantage. I am not doing a business just for 1 day, 1 month, Apple is continuously innovating and striving for quality since last many years which has proved their excellence and perfection in terms of quality. Similar way you can see many many

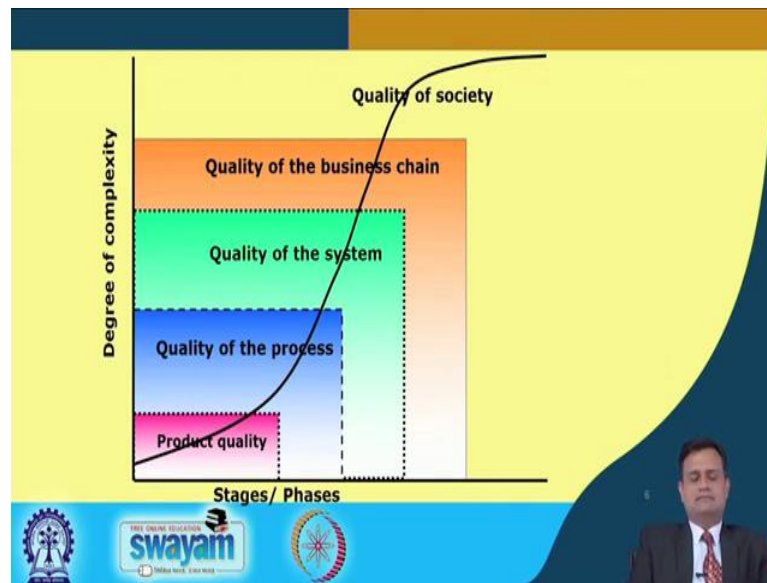
Indian organizations like Tata, TVS, Sundaram, Fasteners and many others they have achieved the excellent business performance by following the quality pursuit.

Second point if you see, customer relations and delight. See, if I want in service sector or manufacturing then quality gives whether it is product or service, remember, quality gives an experience to the customer it is felt, it is realized, it is internalized, and this particular feeling about a quality leads to the image of the organization and customer satisfaction can be converted into customer loyalty. So, when we ask some people they say my family is an Aactiva family, my family is a Tata family, my family is an LG family. It means they develop such a high trust and loyalty in this companies that simply whatever product they want they just go by the brand and purchase it.

To avoid declining work ethics, very important. Just tell me would you like to live in an environment where everything is haphazard, no discipline, no culture; people are just focusing on non-relevant issues, blame game, when you enter into the shop floor everything is shabby, there is no discipline anywhere. So, this kind of lack of quality in culture system leads to deterioration of the work ethics, and when this happens it is not a temporary, but it is a long term impact on the organization. This employee will get trapped into the vicious circle of non-performance and then in this vicious circle more and more number of people will be added, and ultimately it will reduce the efficiency of organizations like anything.

You just see the airline industry and if you analyze the government run airlines in various countries. I will not just name India, but in various countries then for n number of reasons these airlines supported by government are performing very very poorly compared to the private airlines. There are reasons. There are hidden losses, hidden wastages, attitudes, and when you really dig out through a systematic methodology called six sigma you can really identify the barriers inhibitors for achieving quality.

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So, if you look at this diagram, then the picture would be better clear. I may realize the quality at different stages starting from product quality to quality of the process and quality of the system, business chain, and then quality of the society. But if you see the typical curve, plotted here you will realize that it is increasing exponentially. It means as you move from the product quality to quality of the processes and system and society the degree of complexity increases cost of quality increases.

So, remember throughout the discussion of this course, quality can best be ensured at the design stage and if you can do so then subsequently your entire efforts and damage to society can be saved. Just to give you a small example, you have constructed a bridge and it is expected that this bridge will at least serve the society for 50 years.

Now, at the design stage you have compromised with the strength, you have compromised with the increasing demand or usage of this bridge in the future, you have compromised with the architecture, you have compromised with the overall space and other utilities that can be attached with this. Now, all this dimensions gradually will create greater and greater problem. And if this bridge will fail, just see, before say the intended age then there is a great loss to society, and the loss of human life is the highest loss in the society. So, it is always better to control the quality at the design stage.

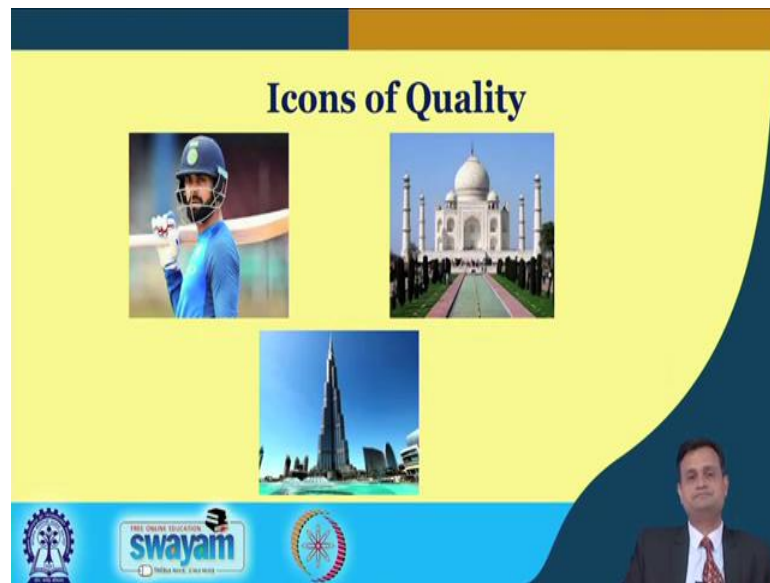
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Now, when we say quality and as I mention it is multi-attribute, multi-perspective dimension, I cannot just say quality the word is good enough. When you make a dish you try to prove try to put various ingredients in certain proportions and that you work and come out with a delicious dish. Same is true when you talk about quality then there are various dimensions which are evaluated one is performance, other is features, reliability, serviceability, durability, appearance, customer service and safety.

Just to appreciate these dimension take an example of automobile. When you want to spend let us say 10 lakh rupees on purchase of a luxury car, all these dimensions will come in your mind. You will not just go by some feature may be technical or nontechnical, but you would also like to see the appearance, you would also like to see the internal ergonomics, design, after sale services, and the availability of the service centre and many more things. So, in order to realize the quality for a product or service a company must address various dimensions.

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Just to give you a long lasting impression your mind about quality, we just look at some icons Virat Kohli, Sachin Tendulkar, Rohit Sharma, your Taj Mahal, Burj Khalifa, the moment we see this we realize quality exist. So, this is a feel that you derive when you really look at such icons which are performing in terms of various dimensions.

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Let us quickly see various definitions and concepts associated with quality.

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W. Edwards Deming

Good quality means a predictable degree of uniformity and dependability with a quality standard suited to the customer.








So, here we would like to review sum of the great contributions and their views on quality. Typically they are called as quality gurus. The first one great contributor in the domain of quality is W. Edward Deming. Now he feels that good quality means a predictable degree of uniformity and dependability with a quality standard suited to the customer. So, if you see he typically emphasizes on uniformity, a uniformity and dependability with a quality standard suited to the customer. So, you must ensure dependability and uniformity to satisfy my customer expectation.

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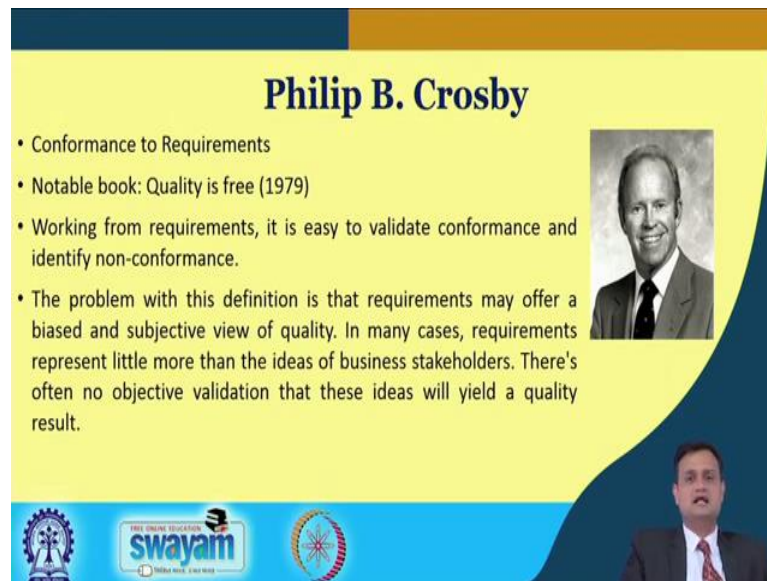
Joseph M. Juran

- Fit for Purpose
- A quality process or product is fit for its purpose.
- If the purpose of an aircraft is to be fast, efficient, comfortable and safe - then that's the definition of a quality aircraft.



If you see the second renowned person Joseph M. Juran, then his definition is very simple - fit for purpose. If I am manufacturing a mobile or automobile, then if this product is not fit for purpose then the quality is lost. So, quality process or product is fit for its purpose. You must look at the purpose. Suppose you are a hospital and your purpose is to ensure the quick recovery of the patient and then your all the processes must put in the frame of quality which can ensure your purpose.

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Philip B. Crosby

- Conformance to Requirements
- Notable book: Quality is free (1979)
- Working from requirements, it is easy to validate conformance and identify non-conformance.
- The problem with this definition is that requirements may offer a biased and subjective view of quality. In many cases, requirements represent little more than the ideas of business stakeholders. There's often no objective validation that these ideas will yield a quality result.

The slide features a portrait of Philip B. Crosby on the right side. At the bottom, there are logos for 'swayam' and 'swayam' with the tagline 'swayam ke chhota chhota'.

Then, we see another contribution from Philip B Crosby, he says: Conformance to Requirement. So, my customer has certain requirements if you tap the voice of customer and identify the requirements and if I conform to these requirements my purpose is served.

He has written a very good book: Quality is free in 1979 and he says that you need not to have tears for the quality. Quality is without tears, quality is free. It means when you are ensuring the reduced variability of your processes through better quality your cost actually goes down and your sales and profitability increases. Now, the only problem when I say conformance to requirement with this definition is that you may get biased and subjective in view of quality, and there is caution that you need to be little bit careful in analyzing the customer requirement with respect to the purpose of the product.

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Kaoru Ishikawa

To practice quality control is to develop, design, produce and service a quality product which is most economical, most useful and always satisfactory to the consumer.




Now, if you see the next contribution then it is from Kaoru Ishikawa. So, to practice quality control is to develop, design, produce and service a quality product which is most economical, most useful and always satisfactory to the customer.

So, customer is very tricky when we ask him he will say, fine give me the fantastic product, meeting the international standards, but do not charge anything. So, that is not possible. What we are trying to do we are trying to set the best bridge between customer expectations and the economy to see that the satisfaction can be maximized.

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Armand V. Feigenbaum

- Total quality control is an effective system for integrating the quality development, quality maintenance, and quality improvement efforts of the various groups in an organization
- "Hidden Plant" - so much extra work is performed in correcting mistakes
- Accountability for quality: Because quality is everybody's job, it may become nobody's job
- The concept of quality costs



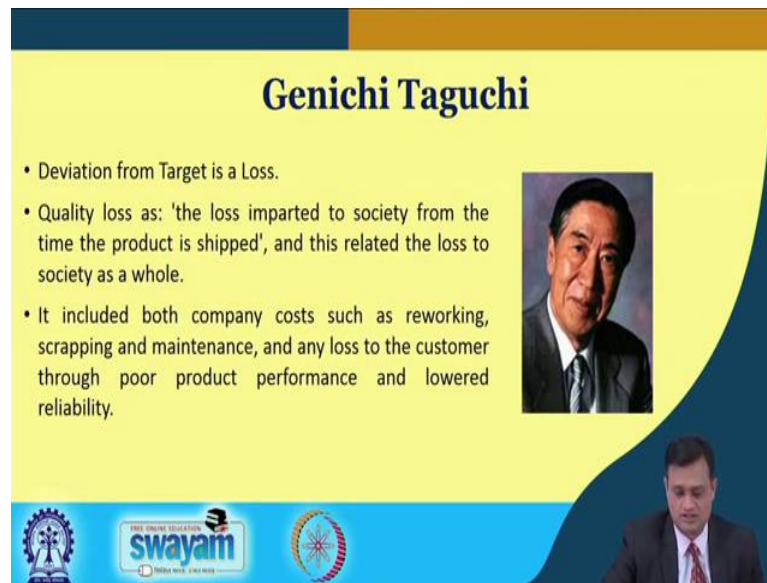
The another contribution is from Armand V. Feigenbaum and he is an advocate of total quality control. What he says that quality cannot be seen in a fragmented way in the organization if you want to deliver the quality for your product or services then it should be seen as an integrated approach for quality development, quality maintenance, quality improvement efforts typically through various groups in the organization.

One very important point Feigenbaum has highlighted that there is hidden plant, hidden factory. What does it mean? It means you would be doing lot of rejections rework fine. Finally, you may correct it, rework it and your final output maybe good but there is a hidden factory or sometimes lot of expenditures on travel and many other thing in order to satisfy the customers. So, all this putting together does not ensure that you are delivering quality unless you are extremely critical about the hidden plant.

Subsequently, if you see then because Feigenbaum believed in the integrated approach of quality he believes that it is the accountability which matters when it comes to quality. So, quality is not like a wrapper which you will put it on the chocolate and your chocolate will say like anything just because of an attractive wrapper that never happens. Quality is everybody's job, it may become nobody's job, so you must see that people associated with quality of individual product and services or the production facility must be sensitized and it should not be left just like everybody's job. Integration of the system through the proper empowerment and commitment is the key to achieve quality.

And he mainly emphasize on measuring the quality in terms of cost. So, later on we will see what are the different quality cost like prevention cost, appraisal cost, external and internal failure cost and so on. And if you really measure the cost of quality you will get an idea that how much you are losing just because of your lack of commitment to quality in your organization.

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Genichi Taguchi

- Deviation from Target is a Loss.
- Quality loss as: 'the loss imparted to society from the time the product is shipped', and this related the loss to society as a whole.
- It included both company costs such as reworking, scrapping and maintenance, and any loss to the customer through poor product performance and lowered reliability.

The slide features a portrait of Genichi Taguchi on the right side. At the bottom, there are logos for 'swayam' and 'INDIA RITE, YASH RITE'.

Now, the another contribution is Taguchi and typically he has given a very beautiful concept which is called Loss to Society. So, he says when you are deviating from the target you can just visualize a normal distribution. We will see it later on. So, when you are deviating from a target basically it is a loss to society because you are producing less A grade product and more B C D inferior quality product which in turn brings lesser value and profitability to the organization.

If such kind of product even though they are within this specification, but quite in the outer range and of C grade or D grade product then when they are put and in use customer satisfaction may go down. So, basically it is a concept of quality loss and loss to society

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American Society for Quality (ASQ)

Quality denotes an excellence in goods and services, especially to the degree they conform to requirements and satisfy customers.

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There is a renowned body American Society for Quality, and they say quality denotes an excellence in good services, goods and services, specifically to the degree they conform to requirements and satisfy customers. So, it is the summary of whatever we have discussed and it is offered by ASQ.

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Caution!

- Quality does not come from using an ISO 9001 quality management system. The ISO9001 standard is not designed to create quality. ISO 9001 is just a “bookshelf” to store and manage your quality creation processes.
- The Effects of Quality are experienced by the customer. Product quality perception comes from your design specifications and the manufacture standards achieved. Service quality perception comes from your service process design and standard of delivery.

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I would like to make a mention that there is a caution. Many companies they do lot of struggle to get the ISO 9001, ISO 14000 and many other standards, but if let us say you are just doing it to decorate your “bookshelf” and having too many documents then your

quality only remains in the documents, it will never come on the shop floor in the organization.

So, it is important to see that these documentation are based on the facts and real practices and just not meager a one day practice to satisfy the requirement of quality standards.

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Quality is the degree to which performance meets expectations. You have played fantastically in one 20-20 match for example; but when you are going for a new match, it is a new match and you have to again perform. So, quality is the degree to which performance meets expectations, every time you have to perform and try to satisfy the expectations.

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Three key elements of quality
(influence a product or service's ability to satisfy customer needs)

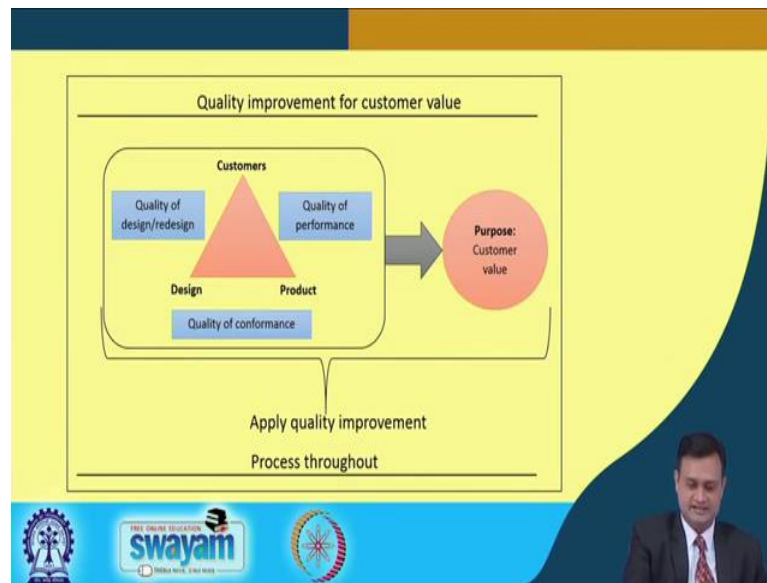
- **Quality of Design:** A product needs to be designed to satisfy customer needs.
- **Quality of Conformance:** Closeness with which the finished product or supplied service matches the specifications of the original design.
- **Quality of Reliability:** the ability of the finished product to provide trouble-free performance in the field, over an acceptable time period.

Logos at the bottom: Swamyam, Ministry of Education, Government of India, and a speaker in a suit.

Broadly if you see, there are three key elements of quality, quality of design, quality of conformance, quality of reliability. When I say design a product needs to be designed in such a way it satisfies the customer needs. It means it must accommodate the customer requirement in terms of product features or service features and it should not unnecessarily, load the service or product in terms of tighter tolerances or extra specifications for which customer would not like to pay.

Second is quality of conformance. So, here closeness with which the finished product or supplied service matches the specification of original design, is very important. So, you may have designed a product even what considering the customer requirement, but when really it is supplied how best it meets the expectations which are conceived at the original design stage. And finally, quality of reliability, so the ability of the finished product to provide trouble free performance; I have purchased a washing machine. I do not want any kind of postal services, I want a robust product and want to see that I must get the service for the intended period of life without any disturbance.

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If you see this diagram as a summary then there are three corners customer, design and product. When I see the interface of customer and design it is quality of design or redesign, when I see the interface of customer and product quality of performance and when I see the interface of design and product it is quality of conformance.

So, apply quality process improvement throughout and the purpose is to ensure the value for my customer. When you ensure the value for your customer, satisfaction and loyalty are just very very small of suits your company will get.

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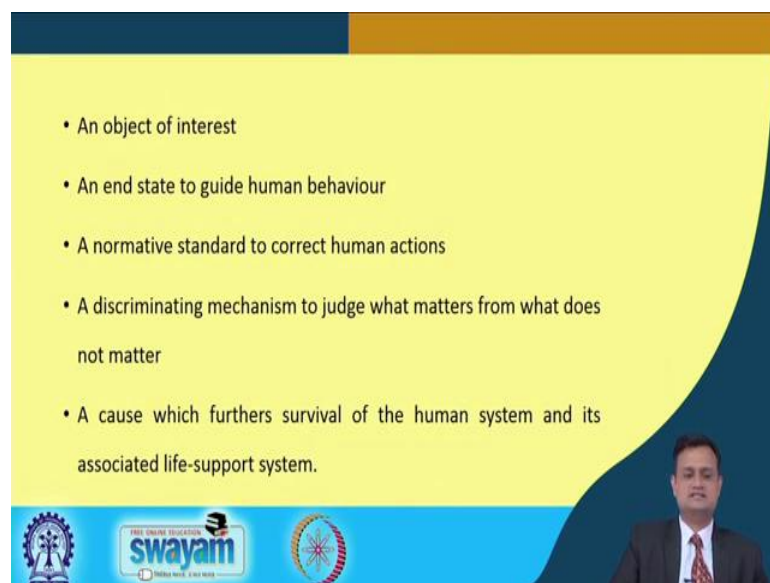
To remind you quality improvement is an ongoing process, continuous process and it is not just like achieving quality one time, having Malcolm Baldrige award one time, having ISO one time and many other certifications and then just an organization in individual they go in a deep sleep.

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So, a standby mode will never help an organization to maintain and improve upon quality standards.

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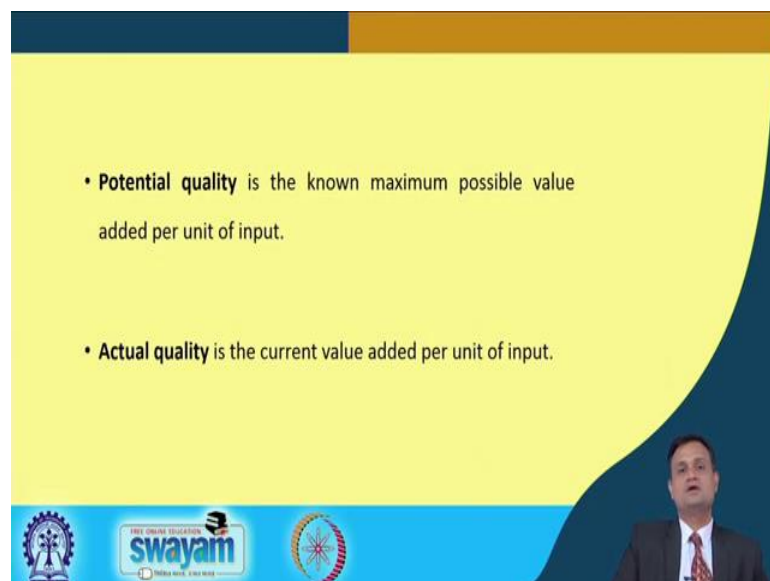
So, quality may be viewed as object of interest, an end state to guide human behavior, normative standard to correct human actions, we should put them back to the expected standard and performance and cause which furthers the survival of human system and its associated life support system.

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So, the flavours of quality: Potential Quality and Actual Quality.

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When you say potential quality is the known maximum possible value added per unit of input, and actual quality is the current value added per unit of input. So, please remember

we always talk about customer value which automatically leads to satisfaction and loyalty of the customer.

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As I mentioned, and again I would like to remind you quality is a multidimensional perspective. It is not a single dimension.

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There are various perspectives business perspective. They would like to analyze what are the alliances which would be beneficial to me, what are the critical processes that needs to be typically targeted, what are the disinvestment opportunities where the collaboration

and alliance will work and how I can overall enhance the quality across my supply chain. There could be a management perspective basically deals with organizing directing and monitoring of the quality on a day to day basis. There could be hands on operational perspective typically focuses on use of appropriate quality tools and expertise.

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So, if I put it in a summary then pursuit of quality is an ongoing journey. As I advance in my age as a human being I must ensure that I am just not advancing in age I must advance in my maturity. I must internalize my learnings. I must internalize my various dimensions which were so far external to the world. So, typically it is a quality management philosophy which needs facilitation internalization from various departments various functions, engineering, R and D, external specialist, marketing operations and so on.

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Business Functions	Responsibility for Quality
Top management	Top-level support and encouragement of quality effort
Quality control	Quality assurance plus promotion, coordination, and control of entire quality effort
Accounting	Measurement of quality costs and quality efforts
Research	Quality of research – proper design and analysis of experimental data
Sales and marketing	Selling a quality product and providing information on field performance

If we quickly see the roles: Top management must provide the sponsorship for the quality. Always remember bottle neck is at the top. You cannot succeed with your quality initiative if top management is not adhering their long lasting commitment to the quality culture and initiative.

Quality control it is a coordinated effort. Accounting, basically measurement of quality cost and sensitizing the people further quality efforts. This must be linked. Research, quality of research - poor design and analysis of experimental data. Sales and marketing, selling a quality product and providing information on field performance.

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Business Functions	Responsibility for Quality
Design engineering	Designing a quality product and changing the design to achieve optimum quality condition
Tool engineering	Providing quality tools, jigs and fixtures
Product engineering	Providing a quality production process
Purchasing	Quality of conformance of purchased goods: feedback of quality information
Manufacturing	Quality conformance in manufacturing, semi-finished, and finished goods; feedback of quality information

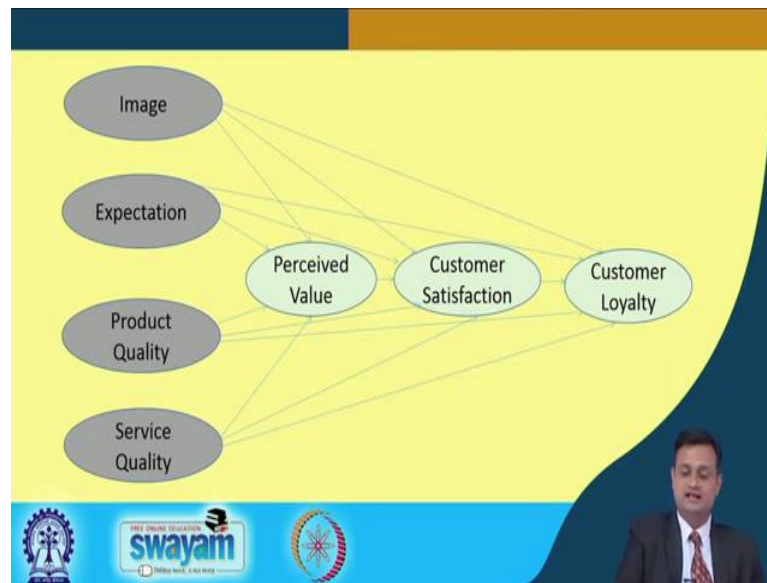
Similar way, design engineering, ensure the quality at the design stage by tapping the customer requirement and their voice. Tool engineering, right quality tools and their availability for manufacturing, product engineering, purchasing and manufacturing; everywhere the department or individual function must commit towards quality.

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So, pursuit of quality there are linkages.

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Just to brief when you see image, expectation, product quality and service quality, you perceive the value as a customer. This perceived value leads to customer satisfaction and finally, you can capture the highest dimension that is the customer loyalty. If you can get the customer loyalty and repeat business from the customer, I will say your organization is blessed with thousands of years of life and you can really survive and progress.

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So, competitiveness, there are various dimensions in which we can see the quality - competitive asset into competitive process. If you talk about competitive asset, it is a

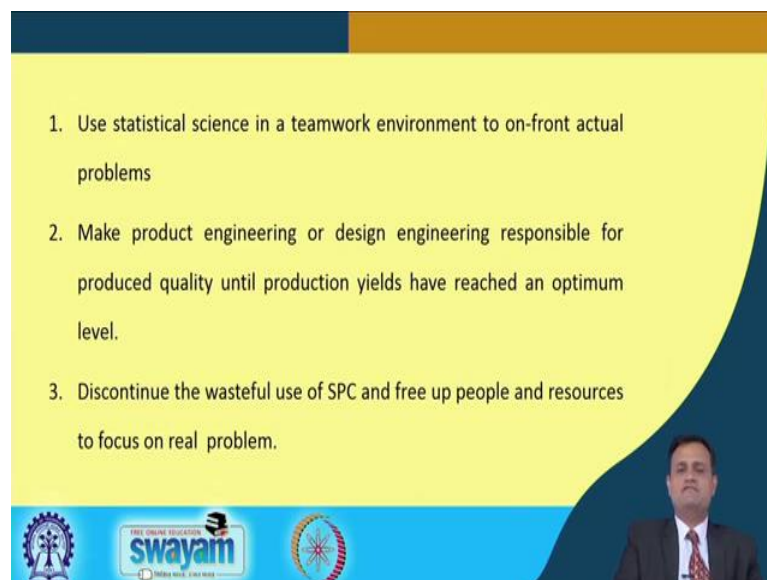
function of technology, human resource, positional assets. And competitive process it is a function of quality, speed, responsiveness and productivity.

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Now, let us try to wrap up with some small discussion. What are the critical challenges for Indian organizations?

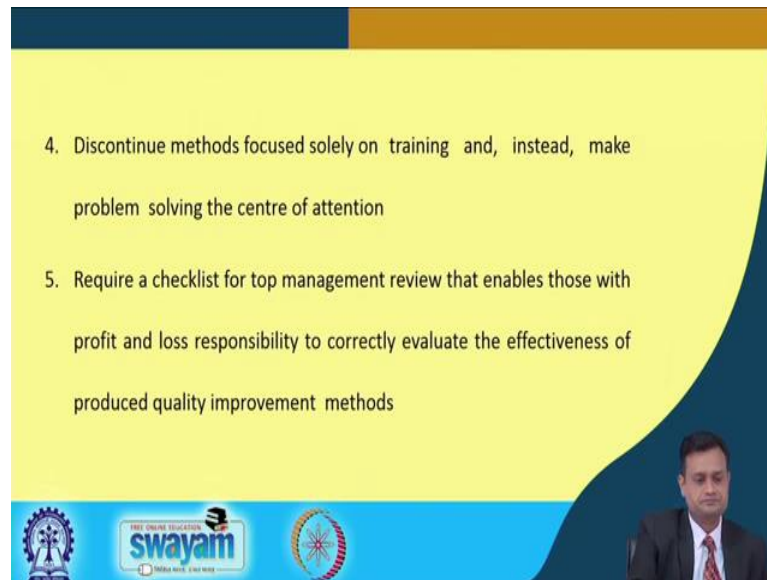
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When we interact with the industry we find that, many industries typically small and medium scale they are still in the very nascent stage and using very very preliminary tools like histogram or maybe bar chart just to improve their consciousness about the

quality. But they need to free time more for inferential quality analysis, statistical based quality control, also many organizations they do too much. I should not have the inferential statistical quality control for all CTQs, critical to quality and I must be critical.

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4. Discontinue methods focused solely on training and, instead, make problem solving the centre of attention

5. Require a checklist for top management review that enables those with profit and loss responsibility to correctly evaluate the effectiveness of produced quality improvement methods

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So, you can discontinue methods focusing solely on training and instead make more problem solving, sustaining culture in your organization.

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**Indian Organizations
Recipient of Deming
Award and Malcom
Balridge Award**

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Let us just see what are the in your organizations received Deming award and Malcolm Baldrige Award. We are at distance, but we mutually can take pride that we have excellence present in India and many company they have proved their excellence.

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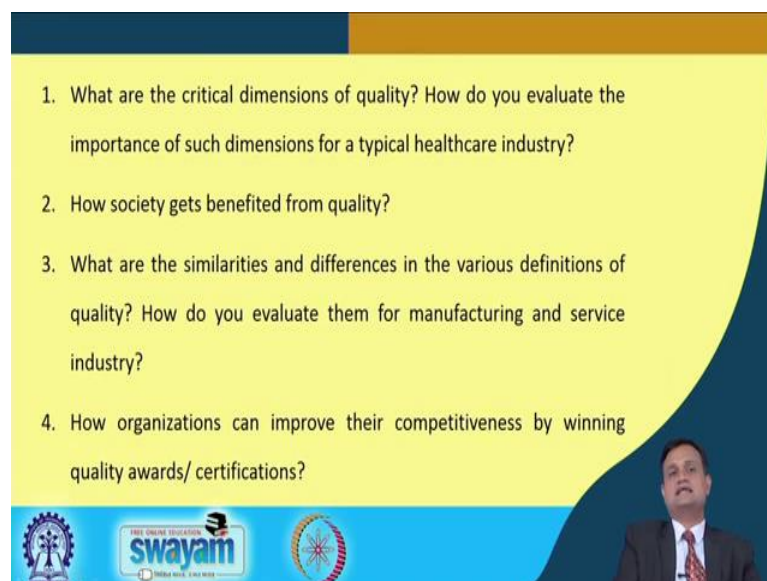
A slide with a yellow background and a dark blue header. It lists several companies that have received Deming and Malcolm Baldrige Awards. The list is as follows:

- Sundaram-Clayton Limited, Brakes Division
- TVS Motor Company Limited
- Brakes India Limited, Foundry Division
- Lucas TVS Limited
- Indo-Gulf Fertilizers Limited
- Krishna Maruti Limited, Seat Division
- Rane Engine Valve Limited
- Reliance Industries Limited, Hazira Manufacturing Division
- Tata Steel Limited

At the bottom of the slide, there are three logos: the Indian government emblem, the 'swayam' logo with the text 'FREE ONLINE EDUCATION', and a circular logo with a gear and a person. A small video inset of a man in a suit is visible in the bottom right corner.

Like Sundaram-Clayton Limited, TVS Motor, Brakes India Limited, Lucas TVS, Indo-Gulf, Krishna Maruti Limited, Rane Engine Valve Limited, Reliance Industries Limited, Hazira Manufacturing Division, Tata Steel Limited and many more.

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A slide with a yellow background and a dark blue header. It contains four numbered questions related to quality dimensions and competitiveness. The questions are as follows:

1. What are the critical dimensions of quality? How do you evaluate the importance of such dimensions for a typical healthcare industry?
2. How society gets benefited from quality?
3. What are the similarities and differences in the various definitions of quality? How do you evaluate them for manufacturing and service industry?
4. How organizations can improve their competitiveness by winning quality awards/ certifications?

At the bottom of the slide, there are three logos: the Indian government emblem, the 'swayam' logo with the text 'FREE ONLINE EDUCATION', and a circular logo with a gear and a person. A small video inset of a man in a suit is visible in the bottom right corner.

So, I would just like to end this session with some think it kind of questions. You must trigger your thinking and try to internalize the overall concept present in this lecture around these questions. First, what are the critical dimensions of quality we have learnt? But how do you evaluate the importance of such dimensions for a typical healthcare industry? Can you really appreciate the various quality dimensions and concepts and make a list of quality dimensions for a typical healthcare industry? How society gets benefited from quality? You can also think otherwise, what is the loss?

What are the similarities and differences in the various definitions of quality? We have seen Deming, Crosby, Ishikawa, Feigenbaum and many, can you just try to tap the commonality and say that yes this is what everybody agrees; and if an organization can create a passion for this then the quality is realized? How the organizations can improve their competitiveness by winning quality awards and certificates? It is a stamp that your organization receives and how it can help in multiple way the organization to be more competitive and profitable.

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So, with this some of the references I keep mentioning, you can refer for this particular lecture.

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Conclusion

Conclusion:

- ❖ Quality is a multi-dimensional perspective.
- ❖ Quality helps the organization to expand their boundaries and be competitive in global market.
- ❖ Everyone in the organization must commit for the quality.
- ❖ Indian organizations need to be critical in adoption of quality initiatives and six sigma journey.

The slide features a dark blue background on the left with the word 'Conclusion' in a yellow script font. The right side has a yellow background with a red 'Conclusion:' header and a bulleted list of four points. At the bottom right, there is a small video feed of a man in a suit. At the bottom center, there are logos for 'swayam' and 'INDIAN INSTITUTE OF MANAGEMENT BANGALORE'.

And there are set of simple conclusions that quality is a multidimensional perspective, helps the organization to expand their boundaries in the global market, everyone in the organization must commit and we have a pride in saying that India is ready for Make in India and we have the organizations set excellence in their pursuit of quality.

Thank you very much for your patience, interest and enthusiasm in learning the various concepts related to quality. We will meet again with a new topic in next lecture. Till that time I request you to revise all the concepts, make a summary note, and also if you can apply to your own processes, I think that would be fantastic to internalize the content deliver.

Wish you all the best.